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ABSTRACT

Provided is an annotated bibliography of items of particular interest to science education. Items are arranged alphabetically by author (or in some cases by title) within each of the following sections: (1) techniques in the lab and field; (2) nature and evolution of science; (3) teaching strategies; (4) curriculum and examinations; (5) young people's development; (6) science facts; (7) management; and (8) general/social concerns and counseling. A list of the U.S. and foreign country periodicals represented in the bibliography is also included. (JN)

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CONTRIBUTORS

Bibliographic details and annotations have been supplied by the Editor and

Mrs Margery Cronshaw *(MC)*
Dos Pueblos High School
7266 Alameda Avenue
Goleta, CA 98117,
USA

Mrs Patricia A Isaacs *(PAI)*
UWI/USAID Project
c/o School of Education
UWI, Cave Hill
Barbados

Dr Julian Duncan *(JD)*
Dept of Biological Science
UWI, St. Augustine
Trinidad

Mrs Sonia Noel *(SN)*
Holy Name Convent
Port of Spain
Trinidad

Acknowledgements in Bibliography No. 6 should have included

Roger F Barnes *(RFB)*
Dept of Biological Science
UWI, St. Augustine
Trinidad

Contributions from other readers of periodicals are invited. They may be sent at any time, and may be handwritten, but should be on file cards 5 inches x 3 inches (12.5 cm x 7.5 cm) or less. If they refer to a periodical not known to be in the School of Education Library, it would be appreciated if good copies of the articles (or the name of a library which will supply copies) were attached.

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THE PERIODICALS

The following periodicals are represented in this issue.

The American Biology Teacher, 42, 6, 7, 8 (1980); 43, 1, 5, 7, 8 (1981). National Association of Biology Teachers, USA.

Astronomy Newsletter, 9 (1981). International Astronomical Union Commission 46 - Teaching of Astronomy.

Cajanus, 14, 2 (1981). Caribbean Food and Nutrition Institute.

Chem 13 News, 123, 124, 125, 126, 127 (1981). University of Waterloo, Canada.

CJE: Caribbean Journal of Education, 8, 1 (1981). University of the West Indies.

EiS: Education in Science, 93, 95 (1981). Association for Science Education, UK.

Eur. J. Sci. Educ: European Journal of Science Education, 1, 3, 4 (1979). Taylor & Francis Ltd (UK) and Institute for Science Education, Kiel, FR Germany.

ICSU-CTS Newsletter, 8 (1981). International Council of Scientific Unions Committee on the Teaching of Science.

IUPAC Newsletter: International Newsletter on Chemical Education, 16 (1981). International Union of Pure and Applied Chemistry Committee on the Teaching of Chemistry.

J. Chem. Ed.: Journal of Chemical Education, 58, 6 (1981). Division of Chemical Education of the American Chemical Society.

Journal of the Association of Home Science Alumnae, XLVV (sic) (1981). New Zealand.

J.R.S.T.: Journal of Research in Science Teaching, 18, 4, 5 (1981). National Association for Research in Science Teaching, USA.

J. Sc. Educ. Japan: Journal of Science Education in Japan, 4, 4 (1980). Japan Society of Science Education.

A Modern Approach to Chemistry: a Newsletter for Chemistry Teachers, 20 (1981). Chemistry Department, Makerere University, Uganda.

New Scientist, 1981-11-19. UK.

NZ Science Teacher, 29 (1981). New Zealand Science Teachers' Association.

Phys. Bull.: Physics Bulletin, 32, 12 (1981). Institute of Physics, UK.

Phys. Educ: Physics Education, 16, 5, 6 (1981). Institute of Physics, UK.

Phys 13 News, 46 (1981). University of Waterloo, Canada.

RECSAM Journal: Journal of Science and Mathematics Education in Southeast Asia, 4, 1 (1981). SEAMEO Regional Centre for Education in Science and Mathematics, Malaysia.

Sc. & Ch.: Science and Children, 18, 8 (1981). National Science Teachers' Association, USA.

Science Journal, 2 (1981). Association of Science Teachers of Jamaica.

The Sc. T.: The Science Teacher, 47, 6 (1980); 48, 5 (1981). National Science Teachers' Association, USA.

SEC Newsletter: Science Education Centre Newsletter, 12, 1 (1981). University of the West Indies, Jamaica.

SICCI Bulletin: Schools Information Centre on the Chemical Industry Bulletin, 22 (1981). UK.

S.S.R.: School Science Review, 62, 221; 63, 222, 223 (1981). Association for Science Education, UK.

TECHNIQUES IN THE LAB AND FIELD

Adutia, D S. Estimation of percentage by weight of iron in a given sample of iron. *A Modern Approach to Chemistry*, 20 (July 1981), 12, 47.

A difficulty is that iron(II) ions become readily oxidised to iron(III). A common solution is to use a "Bunsen Valve", described here. This teacher does not find this satisfactory. His alternative, which has a number of advantages, is to dissolve the sample of iron in sulphuric acid in the presence of ammonium ions. Details are given.

Ainley, D. A small-scale preparation of iron(III) chloride. *S.S.R.*, *62*, 221 (June 1981), 732.

Iron wool burns in a stream of chlorine, precautions being taken to keep the atmosphere dry. Easily done in a school laboratory.

_____. An alternative eluting solvent for the separation of the colouring matters in grass and leaves by paper chromatography. *S.S.R.*, *63*, 223 (December 1981), 337-338.

White spirit (turps substitute) is said to be effective. The writer also describes a simple method of getting a green spot onto filter paper for separation.

_____. The use of screened methyl orange in teaching chromatography. *S.S.R.*, *63*, 223 (December 1981), 338-340.

There are some useful ideas here, not all of them new. Laboratory techniques are clearly described, and easily carried out, but little teaching/learning context is spelt out.

Arnold, B N. Investigating camping gas. *S.S.R.*, *62*, 221 (June 1981), 725-727.

A Gaz stove can be weighed, making it possible to determine the relative molecular mass of the gas by releasing an appreciable volume at RTP. Teachers without a Gaz stove may be able to adapt a Gaz lamp. Suitable for the study of gas laws and hydrocarbons in O- and A-level chemistry.

Benson, C L; Hobbs, A P; Pegorini, M; Sturgeon, S G; Taplin, C E. The thermal shrinkage of dogfish fin ray collagen. *S.S.R.*, *62*, 221 (June 1981), 693-696.

A simple technique for a class practical to investigate protein structure and denaturation. The authors found that hydrogen bonds play an important part in stabilising the helical structure, but that electrovalent and disulphide bonds are also involved. Although the measurement of length is not described, a physics colleague with a vernier microscope should be able to help, while a chemistry colleague might provide the test solutions and buffers. Recommended for A-level biology and possibly chemistry teachers.

Bergamasco, G; Zini, G. A simple example of the use of Thevenin's Theorem. *Phys. Educ.*, *16*, 5 (September 1981), 312-313.

The article concerns the effect of the resistance of the voltmeter in voltage measurements. The strategy is to startle students by their findings (perhaps the sort of roller-coaster advocated by Bruner?). If you have the range of instruments required, the idea is recommended to upper secondary and lower tertiary physics teachers.

Berry, M. [Alkali metals in water.]. *Chem 13 News*, 123 (May 1981), 10.

A bunsen flame in the neighbourhood shows that something (what?) is in the atmosphere. Easily tried.

Burgess, B J. A simple experiment to show the migration of ions. *S.S.R.*, *62*, 221 (June 1981), 717.

A class experiment using filter paper instead of jelly. It takes only about 10 minutes, but you would need enough 20 V supplies for the whole class.

Byrne, M S. Solar energy: a simple investigation. *S.S.R., 62,* 221 (June 1981), 749-751.

All you need are some metal trays, glass plates and vermiculite (available locally for hydroponics). Variables are manipulated, and the investigation can be used to teach scientific process, the design of solar panels, black and white radiating surfaces, insulation, the greenhouse effect, and energy comparisons. Even in England, the maximum temperature rise (black water + insulation) was 12°C.

Cantellow, R. Depolarizing a simple cell. *S.S.R., 62,* 221 (June 1981), 756-757.

The standard potassium dichromate method is replaced by a known oxygen giver (hydrogen peroxide). Full teaching details are given.

Cherkas, A. Oxidation of alcohols. *Chem 13 News,* 127 (December 1981), 10-11.

The oxidation is carried out with potassium dichromate or potassium permanganate solution. If you have access to a range of primary, secondary and tertiary alcohols, you can stimulate your students in some high level cognitive processes. Lab techniques and teaching notes are given.

Clappison, A J. The effect of pressure on rate of reaction. *S.S.R., 62,* 221 (June 1981), 717-718.

The method requires two 75 mL syringes filled with hydrogen sulphide and sulphur(IV) oxide at different pressures. The method is qualitative only.

Cox, G; Atteshlis, L. Two more useful tablets. *S.S.R., 63,* 222 (September 1981), 190.

Camden tablets, used in home wine making, are a source of sulphur dioxide; *Puritabs,* used to purify drinking water, appear to release chlorine. They may not be available locally, however.

Daryll Evans, J. Worms and light with juniors. *S.S.R., 62,* 221 (June 1981), 754-755.

Given that an experiment is a test of a hypothesis, this is an experiment (a quantitative one) which will help first formers understand what science is all about. The materials are easily available anywhere.

Falk, J H. Taking advantage of local resources: lawns - a case in point. *The American Biology Teacher, 42,* 6 (September 1980), 351-352, 355.

This describes an investigation into insect populations before, and at intervals after, mowing. It is easily carried out, provided you can supply muslin sweepnets, and have a good relationship with the maintenance staff. Extension to other living specimens would add interest to this ecological study. *(MC)*

Freeland, P W. Watercress *(Rorippa nasturtium aquaticum):* small scale cultivation and use in water-culture experiments. *S.S.R., 63,* 223 (December 1981), 277-280.

After growing your watercress in plant pots or trenches (details supplied), you can investigate factors affecting the regeneration of excised stem apices. The article reports studies into effects of pH and mineral ion deficiencies. Watercress seems to have advantages over other plants commonly suggested in textbooks, and is a familiar crop here.

Frimpter, B J; Doughty, R E. Food labs, an approach to science. *Sc. & Ch., 18,* 8 (May 1981), 5-7.

Working on the principle that teenagers love to eat and find food fascinating, a series of activities are suggested which investigate variables, mass, freezing point, solubility, separating components etc. *(PAI)*

Goodall, D M: Morris, R F. Colorimetric determination of the equilibrium constant for reaction between iron(III) and thiocyanate ions in aqueous solution. *S.S.R., 63,* 223 (December 1981), 302-305.

The writers have found that with this method equilibrium conditions are rapidly achieved and equilibrium concentrations can be readily measured. It is used with first term undergraduates and (with a minor modification) with sixth formers. Specimen data are provided.

Griffith, J S. Alternative uses for an environmental comparator. *S.S.R., 62,* 221 (June 1981), 736-737.

If the biology department has this apparatus, it can be useful in the physics department for the detection and measurement of radiant heat, comparison of brightness of light sources, relationship between current flow and brightness in an electric lamp, and demonstration of the inverse square law.

Harrison, A W. Experimenting with solar collection and radiation cooling. *The Sc. T., 47,* 6 (September 1980), 29-31.

This is a physics experiment which investigates the effect of different coloured paints on surfaces placed in the sunlight all day. Part of it uses very simple equipment, but the second part requires the construction of 3 simple boxes. Although, as described, the experiment is suitable for a fairly advanced student project, primary or lower secondary teachers could modify the technique and prune it, if desired, down to a simple demonstration of absorbing effect of different coloured surfaces. Attention is *not* drawn to the hazard of viewing the sun with the naked eye.

Hassall, T. Young's experiment. *NZ Science Teacher,* 29 (June 1981), 46.

This teacher found that double slits are more conveniently made by the class from aluminium foil than from graphite suspension. As no other details are provided, you have to be already familiar with the standard set-up.

Herrmann, R. Photographic "hypo" waste to silver nitrate. *Chem 13 News,* 124 (September 1981), 4.

Silver nitrate is now *very* expensive. If your school has a photography club, or if you know anyone who uses a lot of hypo, you can extract the silver compound and re-use the hypo. About 5 g $AgNO_3$ per litre of hypo can be expected. This could be a good activity for a science club. See also Stevens on p. 31 below.

Jackson, W R C. Oxidation of aqueous iron(II) ions by aqueous chlorine. *S.S.R., 63,* 223 (December 1981), 317.

This is a class activity easily carried out in test tubes as an alternative to the better known teacher demonstration.

Jardine, J. *F = ma:* not another approach! *S.S.R., 63,* 222 (September 1981), 139-141.

Jim Jardine recommends, and provides notes for the use of, Griffin and George's dial dynamometer.

Jones, C. Alternative energy projects in schools. *S.S.R., 63,* 223 (December 1981), 260-266.

In spite of the title, the article describes the designing, construction and testing of a solar panel by a group of 12-14 year olds in a comprehensive school. The project took two years, but the children gained much.

Lewis, J I. Amphoterism - a practical quantitative assessment. *S.S.R., 63,* 222 (September 1981), 128-130.

The method tested was to produce the hydroxides of the elements, plotting the pH against the volume of KOH. The initial slopes of the curves readily distinguished between basic, amphoteric and acidic substances.

Luker, H. A simple ringing experiment using Impatiens. *S.S.R., 63,* 222 (September 1981), 105-106.

Pupils were to find out whether removal of a ring of phloem would affect the formation of adventitious roots. Although other cuttings can be used, Impatiens shows results within 3 weeks. The experiment provides opportunities for teaching about controlling variables and making further hypotheses. Suitable for any level from primary to advanced.

MacDonald, J J. Electrolysis of molar sulphuric acid. *S.S.R., 62,* 221 (June 1981), 789-790.

This letter follows a project described by Meek (Bibliography No. 5, p. 3). A pupil who tried it confirmed the very variable nature of the anodic gas, but failed to determine its nature. The teacher is puzzled.

McNaught, I J; McNaught, C M. Stimulating students with colourful chemistry. *S.S.R., 62,* 221 (June 1981), 655-666.

When the teacher demonstrates, it is best if pupils can expect him to do something dramatic as well as instructive. Here are 12 bits of 'magic' for a range of levels (e.g. Wizard's cauldrons, beating heart, disappearing orangeade), which can be followed by hypotheses and discussion of the chemistry behind the magic. Some of the chemicals may not be readily available.

Mace, W K. Energy from force-distance curves. *S.S.R., 63,* 222 (September 1981), 142-143.

The idea is to determine the energy stored in stretched rubber bands (used as catapults) and home-made springs. Applications (e.g. car safety) are suggested. A-level.

Marshall, J. How to bend a ray of light. *S.S.R., 63,* 222 (September 1981), 141.

A laser is used to pass a beam through the usual rectangular tank containing water and glycerol.

Meyer, A D. Effects of a tobacco suspension on euglena. *The American Biology Teacher, 43,* 8 (November 1981), 454-455.

Protists can be used to study the effects of a tobacco suspension. The procedure is clearly explained and teaching opportunities are suggested. *(MC)*

Miller, G C. It's beanium. *J. Chem. Ed., 58,* 6 (June 1981), 507-508.

This is an analogue activity in which pupils determine the relative atomic mass of beanium and its isotopes (3 different kinds of beans). The worksheet is provided, and includes pre-lab and post-lab assignments. Suitable for 4th form physical science.

Moody, D. Ant trails. *The American Biology Teacher, 43,* 8 (November 1981), 452-453.

A field study, needing minimal materials for the study of ants, this could be used with students of different ability levels. This investigation would add to the understanding of pheromones. *(MC)*

Morris, R F. An experiment to determine the solubility product of lead(II) iodide. *S.S.R., 62,* 221 (June 1981), 712-713.

A dropping pipette is used to titrate lead(II) nitrate with potassium iodide, a simpler and conceptually easier approach than other published methods. As the success of the determination depends on the care taken by the students, the experiment could be used to assess practical techniques.

Nath, N; Chaturvedi, S N. The χ^2 test and goodness of data. *Phys. Educ., 16,* 6 (November 1981), 380-382.

The test is common in life science and educational research, less so in physics. These authors believe that physics students should be shown the usefulness of a statistical test in arriving at conclusions from experimental data. They show how this can be done with background radiation detected by a scaler. The description is rather thin for those not familiar with the χ^2 test. The idea may appeal to teachers of university students who tend to collect large quantities of data, and then make categorical assertions about them.

Nechamkin, H. The recovery of nickel from stainless steel. *Chem 13 News,* 124 (September 1981), 6.

If you wish to show how materials can be recovered from household or industrial trash, while providing opportunities to learn some descriptive inorganic chemistry, try this treatment of razor blades. As well as more common reagents, you will require solid NaF and dimethylgloxime.

Page, R S. Sodium benzoate - a neutral salt? *S.S.R., 63,* 223 (December 1981), 312-313.

Free benzoic acid impurity in sodium benzoate as bought was the cause of the salt failing to give an alkaline result with indicator. This provided an opportunity to carry out a solvent extraction of the benzoic acid. Examine your bottle of sodium benzoate to see if it lends itself to the same idea.

Parker, R. The tungsten filament lamp. *S.S.R., 62,* 221 (June 1981), 790-791.

A 6th former carried out the common investigation of I/V and R/V characteristics for a 12 V lamp. Instead of the usual rushed write-up, he went on to derive $V \propto I^{1.67}$! This agrees with observed results. Secondary and tertiary physics teachers will be interested and may wish to discuss this with their students. D Hinson, in a letter in *S.S.R., 63,* 223 (December 1981), 375 makes further observations.

Partridge, D A. Solvent polarity and solvatochromism. *S.S.R., 63,* 223 (December 1981), 314-317.

There is no satisfactory general scale for the quantification of solvent polarity. In this article the author describes a method for quantifying the polarity of various solvents when a solvatochromic compound is dissolved in them. It requires a spectrophotometer and some reagents which you may not have. There is good opportunity for developing laboratory and cognitive skills.

Pedwell, D. A jug of color. *The Sc. T., 47,* 6 (September 1980), 44.

If you are into chemical magic, here are some more strategies for your repertoire. The note tells you how to get a variety of colours from Fe^{2+} and Fe^{3+} salts, but you will have to develop your own educational context.

Saunders, S. The chemistry and magic safety show. *Chem 13 News,* 127 (December 1981), 4-5.

This article describes 9 demonstrations used in a 30-minute show for 9-12 year old children whose schools lack laboratories. The demonstrations are spectacular and dangerous, and safety is emphasised. The author also claims to demonstrate basic scientific principles and process, but it is not clear that this is actually done.

A simple test for lead-based paints. *A Modern Approach to Chemistry,* 22 (July 1981), 22.

The test involves shaking paint flakes with sodium sulphide. A useful project for lower secondary.

Sivan, Y. The thermal expansion of metals - an improvised demonstration. *S.S.R., 62,* 221 (June 1981), 757.

Using the most standard laboratory apparatus, you can demonstrate (even compare) linear expansion.

Smith, S. A small-scale lime softening plant. *S.S.R., 63,* 222 (September 1981), 131-134.

This is a laboratory demonstration of Clark's process for softening water, still used in industry. It is quite easily set up, and careful details are provided. There are only scant suggestions for teaching with it, but it could be associated with our local Water Authority's procedures.

Somerfield, A E. The speed of electromagnetic waves - Lecher goes modern. *S.S.R., 63,* 222 (September 1981), 137-138.

Customers of R S Components should find it easy to set up this analogue of Kundt's tube. The oscillator was found to give a value for *c* very close to the accepted value.

Stead, D E; Mottley, J. A simple technique for demonstrating the role of ethene in fruit ripening. *S.S.R., 62,* 221 (June 1981), 702-704.

Our farmers know that calcium carbide accelerates the ripening of fruit. This class investigation from Malawi is based on the absorption of ethene by potassium manganate(VII) in polythene bags, delaying ripening. Data are given for our common fruits (e.g. banana, mango, avocado pear), and a number of variations are suggested. Very easily set up with a whole class or by a student for his CXC project, and might be considered for a science exhibition entry. Or use it at home to store your own produce, observing (described) precautions about fungicidal treatment (ripening of avocadoes delayed by 10 days, lime by 16, mangoes by 5).

Stevens, I H. Polyphenol oxidase - an easily available enzyme. *S.S.R., 63,* 222 (September 1981), 103-105.

The enzyme is responsible for browning in fruits and vegetables. The article describes a set of tests of hypotheses, easily carried out if catechol is available.

[Testing water for free chlorine.] *Chem 13 News,* 125 (October 1981), 13.

Simply carried out with potassium iodide and starch indicator. A qualitative test only.

Turton, B; Buckle, A. The preparation of chromium(II). *S.S.R., 63,* 223 (December 1981), 313-314.

Methods cited in the literature are unsatisfactory. The method described here is very simple and the chromium(II) remains stable for several days. It depends on the use of propan-2-ol. An explanation is given.

Underhay, V H S. Microbiology of the phylloplane - a habitat suitable for microbiological project investigations in sixth-form and college. *S.S.R., 63,* 223 (December 1981), 280-284.

The phylloplane, the leaf surface, supports an interesting microbial population. The title of this article describes its content very well. Precise details are left to the reader, and the writer suggests seasonal investigations not appropriate to the tropics. Advanced botany teachers should, nevertheless, be able to adapt the ideas.

Veenstra, T. Metals in jewellery. *Chem 13 News,* 124 (October 1981), 14.

Using materials found in any chemistry lab, this jeweller's test can be used to determine quickly the type of metal. One possible project is to test coins. There is a rather high concentration of nitric acid, making the exercise unsuitable for younger children.

Voice, E. Pumping liquid metal to explain motors, dynamos and Fleming's rules. *S.S.R., 63,* 223 (December 1981), 318-322.

In principle, the idea is interesting as an illustration of the application of physical laws to industrial processes. In practice, I know few physics teachers who would go to the trouble of digesting the instructions and then constructing the apparatus. If you are one of the exceptions, you will probably find it worthwhile.

Ward, A. Those clever Jumblies: an amusement with surface tensions. *S.S.R., 62,* 221 (June 1981), 751-752.

You *can* go to sea in sieve - unless there is someone around who understands about detergents. Another of Ward's ways of making science fun with juniors.

_____. An exploding 'cottage'. *S.S.R., 62,* 221 (June 1981), 752-754.

Ward is not the first person to demonstrate an explosive mixture in a dramatic way. However, he adds a few refinements and increases the drama. Although Ward does it with primary children, chemistry teachers might try it with any level. No difficulty with materials.

Williams, J. Building solar furnaces - an example of science in a primary school. *S.S.R., 63,* 223 (December 1981), 267-276.

Several designs were constructed, water was heated and a sausage was cooked. The teacher wishing to replicate this project would need some facility with wood working, and would need to face up to an extended project.

Worsnop, J G. Conductance and cell dimensions. *S.S.R., 62,* 221 (June 1981), 709-712.

This describes a simple method of determining a cell constant for A-level electrochemistry. For copper(II) sulphate(VI), it confirms that the conductance of the solution is directly proportional to the cross-sectional area of the cell and inversely proportional to the path length of the current; and provides other teaching points as well.

NATURE AND EVOLUTION OF SCIENCE

Brandon, E. Teaching epistemic responsibility. *Science Journal, 2* (1981), 43-44.

A teacher educator is concerned that teachers (including science teachers) do not have an adequate stance on the quality of evidence. While insisting on accurate bench measurements or correctly applying tests of significance in educational research, they then expect their pupils to accept uncritically authoritative statements from books or themselves make wild extrapolations from the data. This lack of understanding affects the attitudes and values acquired by the pupils.

Cotham, J C; Smith, E L. Development and validation of the 'conceptions of scientific theories test'. *JRST, 18,* 5 (September 1981), 387-396.

Describes the development etc of a test for elementary and secondary science teachers which has the following characteristics: 1) sensitivity to alternative conceptions of particular philosophic aspects of scientific theories, and 2) applicability in inferring understanding of the tentative and revisionary conception of the nature of science. *(PAI)*

Hodson, D. The nature of scientific knowledge. *S.S.R., 63,* 223 (December 1981), 360-365.

A number of views of scientific knowledge are explored. The writer concludes with his own view that the practitioners of science have refined and regulated their activities over the centuries so that the work of each individual is informed and regulated by his colleagues.

Jones, H G; Mooney, R J. An approach to conceptual difficulties in physics. *Phys. Educ., 16,* 6 (November 1981), 356-359.

This article might be better titled "Presenting physics as a concept". It describes an introduction given to first year undergraduates, but is also recommended for 6th formers. Beginning with the "physics of experience", students are shown that a conceptual barrier exists between classical physics on the one hand and relativistic physics and quantum physics on the other. They acquire a perspective of the unity of the subject. Useful reading for any physics educator.

Lind, G. The History of Science Cases (HOSC): nine units of instruction in the history of science. *Eur. J. Sci. Educ., 1,* 3 (July-September 1979), 293-299.

This is essentially a review of ninth and tenth grade teaching materials developed by Klopfer some years ago. While the units are not perfect, and do not aim to provide a complete course, they appear to be most useful resources for a neglected aspect of the curriculum.

Manuel, D E. Reflections on the role of history and philosophy of science in school science education. *S.S.R., 62,* 221 (June 1981), 769-771.

The writer believes that, if they are to teach science effectively, teachers need a background of the history and philosophy of science. This should be taught to sixth formers and in university science and education departments.

Paoloni, L. Towards a culture-based approach to chemical education in secondary schools: the role of chemical formulae in the teaching of chemistry. *Eur. J. Sci. Educ., 1,* 4 (October-December 1979), 365-377.

The writer considers the base of chemical education in general education for ages 13-18, stressing the need for an intellectual level at least equal to that of other subjects. He favours an approach in which classical chemistry (1874-1935) is taught to ages 13-14, followed by quantum-chemical concepts for older students. While some of the treatments in textbooks do reflect current ideas, there remains some confusion. Teachers attempting to conceptualise their subject should find it useful to reflect on Section 2, which lists central postulates and assumptions.

Selley, N J. The place of alternative models in school science. *S.S.R., 63,* 223 (December 1981), 252-259.

Most pupils currently acquire a view of science as a well-defined system of facts, theories and concepts. If they can grasp these at all at the stages when they are taught, the resulting knowledge tends to be inert. This writer proposes that the teacher should accept models (theories) appropriate to the pupils' current stages of perception, intending in the long term to see that the models are revised and improved, or abandoned, as the children's cognition develops. In this way, the children would acquire knowledge better, and would grasp something of the philosophy of science, *using* their knowledge to develop the models.

Slaughter, J B. [Recent scientific achievements.] *Chem 13 News,* 125 (October 1981), 4-6.

The director of the National Science Foundation summarises new findings and ideas in physics, chemistry, earth sciences, biology and social sciences. It is readable enough for 6th formers, and could help them to realise that their textbooks are nowhere near the frontiers of knowledge.

West, R W. The teaching of the history of science and technology. *EiS,* 93 (June 1981), 18-20.

The ASE has looked into the question of the history of science and technology in the context of school science and history syllabuses. The 11-16 curriculum was seen as a priority area, and it was felt that support materials should be produced for existing syllabuses. The findings of a survey, and the recommendations of the Working Party, are given.

Woolner, K A. Michael Faraday. *Phys 13 News,* 46 (October 1981), 8.

A chart showing the life and works of Faraday set against the works of other physical scientists of the time. It could be readily copied for a 6th form class, or a 5th form whose teacher favours a historical context.

TEACHING STRATEGIES

Arnold, B N. Catching the secret letter writer. *S.S.R., 63,* 223 (December 1981), 336-337.

Paper chromatography with black-ink pens generally leads to nothing beyond a dishonest "Is ink a pure substance?" While this writer does not discuss how the relevant concept can be developed, he at least suggests how the experience can be made exciting. The Wreake Valley project had the same idea.

Ball, P W. The use of cards for teaching periodicity and chemical bonding. *S.S.R., 63,* 222 (September 1981), 122-128.

The cards interlock and are first used to introduce atomic structure and electron configuration. They can then be used to build up the periodic table and to show ionic and covalent bonding. This is similar to Jones' idea (below), but the cards are more complex.

Banks, B; Bennett, C. The use of games in science teaching. *Science Journal, 2* (1981), 31-34.

These teachers give a rationale for the use of games in teaching and assessment, and describe three games suitable for secondary biology. There is a short bibliography.

Bard, J R. A moiré pattern analogy to electron motion. *J. Chem. Ed., 58,* 6 (June 1981), 480.

This is a visual aid in which the apparent motion expands, contracts and oscillates without set pattern. It should help O-level chemistry pupils visualise the simultaneous motion of electrons in orbitals of differing types. The moiré pattern provided can be easily copied - a projection slide is suggested.

Blair Gould, R J. Chemical element identification game. *S.S.R., 63,* 222 (September 1981), 190.

One advantage of this game is that the teacher has to do almost no preparation. Used as revision in A-level inorganic chemistry, it should help students take an overview of the subject as well as exercising their memories about detailed properties of elements and their compounds. Intensive group discussion appears to be another outcome.

Brandon, E. The effect of different teaching methods on attitude towards and achievement in physics. *Science Journal, 2* (1981), 40-42.

This is a précis of an experiment by Deniz Onac, who taught matched groups of Grade 9 pupils - one by an extreme teacher-centred approach, the other by guided discovery. After 6 weeks, there was little difference in the groups; but the guided discovery pupils, after a slow start, developed tremendous enthusiasm. Brandon concludes that as far as communicating information and understanding goes, both approaches have value.

_____. Logic in the laboratory. *S.S.R., 62,* 221 (June 1981), 762-765.

The argument is that "discovery" in science teaching is dishonest and that "history" is misleading. The author believes that science teaching will become closer to science if what is known (or believed) is presented, and then subjected to rigorous testing. The focus in practical work would then shift, indeed become less incoherent. This approach could at last provide a meeting point between teachers and teacher educators.

Capie, W; Tobin, K G. Pupil engagement in learning tasks: a fertile area for research in science teaching. *JRST, 18,* 5 (September 1981), 409-417.

There are few studies on pupil engagement so far, in spite of some indication of substantial relationships between it and student achievement and teacher performance. Numerous research questions are posed which could be the basis of many interesting studies, particularly at the Dip Ed level. *(PAI)*

Chokotho, N C; Leisten, J A. A symposium for students. *J. Chem. Ed., 58,* 6 (June 1981), 490-492.

Supervision of projects is demanding on staff. This approach in a chemistry course at the University of Malawi has proved economical, and might also be applied in high schools. Students investigate different aspects of the same kind of reaction (in this case, halogenation of ketones). The symposium which follows can be relatively brief, since all participants are familiar with the basic phenomena. Twenty problems are listed, and each is accompanied by a note on the issues the student is expected to face. The idea would interest all science teachers who do, or would like to, give projects; but the *details* are only for 6th form and university chemistry teachers.

Davis, B. Physics lectures and student notes, Part 2. *SEC Newsletter, 12,* 2 (November 1981), 6-8.

Bibliography No. 6 (p. 5) mentioned Part 1. This article continues the discussion about difficulties shown up by carbon copies of lecture notes, and recommends that other lecturers try the same strategy.

Dreyfus, A; Eggleston, J F. Classroom transactions of student-teachers of science. *Eur. J. Sci. Educ., 1,* 3 (July-September 1979), 315-325.

The Science Teacher Observation Schedule (STOS) was used in Britain to observe student teachers at 3 stages in their teaching practice and to compare them with experienced teachers. The training appeared to have an adverse effect, more so with biology and chemistry teachers than with physics teachers. An explanation is given in terms of a stereotype perception of how the discipline is taught, with training developing a "caricature" of teacher behaviour, exaggerating the stable or safe transactions. One wonders just how generalisable these findings are.

Earles, T T. Crystallize your students' interest. *Chem 13 News,* 125 (October 1981), 13.

A crystal of copper(II) sulphate is kept growing for a whole year and may even reach 1 kg in mass. Full details are given. The project is used to introduce a number of topics, and this teacher finds that it generates much enthusiasm. However, it requires at least 6 kg of $CuSO_4.5H_2O$, although no doubt the remaining solution can be topped up in subsequent years.

Element hunt. *Chem 13 News,* 126 (November 1981), 6.

The idea is to find how many symbols are in the word CHEMISTRY (at least 25). Other chemical words might be used in the same way; ideas are given in No. 129 (February 1982), 2. For example, SCANDIUM contains 22 elements plus Sc itself.

Feinstein, H I. Motivation and relevance in chemistry. *Chem 13 News,* 126 (November 1981), 3.

The writer suggests that pupils can be motivated if theoretical chemistry is related to its applications, as in the biological sciences. He illustrates how this can be done with reaction rate. His problems require students to interpolate in curves (or equations) of time/temperature. In fact, apart from the type of curve, there is no chemistry at all. However, students might find them interesting when learning how to use similar techniques in chemistry.

Fulkrod, J E. How big is Avogadro's Number (or how small are atoms, molecules and ions)? *J. Chem. Ed., 58,* 6 (June 1981), 508.

A strategy to give some idea of the magnitude of 6×10^{23}.

Goosen, B; Daniels, D J. Match. *S.S.R., 63,* 222 (September 1981), 142.

A card game to revise elementary definitions and units of measurement.

Gradwell, P R. Floating magnets and crystal lattices. *S.S.R. 63,* 223 (December 1981), 313.

Ring magnets floating in the usual way provide an analogue of the way charged ions are 'sprung' in a crystal lattice.

Graham, W S. The spider's web. *S.S.R., 62,* 221 (June 1981), 700-701.

A board game for teaching about insects or classification, suitable for lower secondary.

Griffiths, R W. Dramatizing astronomy. *Sc. & Ch., 18,* 8 (May 1981), 16-17.

A series of nice activities that could be used by 9-13 year olds to help consolidate the idea of the moon's rotation and revolution. Could easily be extended to include motion around the sun, and eclipses. *(PAI)*

Hawley, J W. The bicycle - a useful resource. *S.S.R., 63,* 223 (December 1981), 340-341.

Some brief notes on applications to various content areas in primary science. The resource, rather than the science, appears to be the focus.

Hayward, R J. Fleming - left or right? *S.S.R., 62,* 221 (June 1981), 792.

An easy way to remember which is which.

Hillman, R A H; Hudson, M J; McLean, I C. A preliminary study of some of the learning and assessment difficulties in connection with O-level electrochemistry. *S.S.R., 63,* 222 (September 1981), 157-163.

This describes an experiment in which matched groups of pupils were given matched tests, one test having fewer technical words than the other. Implications for teaching and assessment are discussed. O-level chemistry teachers will be interested in this article.

Hollyman, C J. A simple model of the α-helix. *S.S.R., 62,* (June 1981), 730-732.

Using thin card, students can construct their own models, which can be hung at home to "impress mum, dad and visitors". Full details are given. Because of the stereochemistry, this is recommended for A-level chemistry classes.

Hudson, M J; Bennett, A J. RANALD I - an introduction to qualitative inorganic analysis. *S.S.R., 63,* 222 (September 1981), 156-157.

This outlines a CAL package in which an unknown compound is selected at random by the computer. The student selects the tests and is told the results of these. The article also gives information on sources of other software.

Hutton, A T. Dramatic demonstration for a large audience: the formation of hydroxyl ions in the reaction of sodium with water. *J. Chem. Ed., 58,* 6 (June 1981), 506.

This describes the use of a large dish on an overhead projector, together with an appropriate indicator. With nitrazine yellow, the travelling sodium traces a blue trail on a yellow background.

James, H J; Nelson, S L. A classroom learning cycle: using diagrams to classify matter. *J. Chem. Ed., 58,* 6 (June 1981), 476-477.

Most physical science teachers find themselves having to teach the abstract ideas of atom, molecule, element, compound, solution and heterogeneous matter to children still at Piaget's concrete stage. These authors describe an approach which they have found successful.

Jones, A V. Chemical formulae take shape. *S.S.R., 63,* 222 (September 1981), 118-122.

Believing that children should be taught formulae before the 4th year, the writer and his students have developed a scheme which uses interlocking cards. There is evidence that it works, and children should enjoy it. See also Ball (above).

Jungwirth, E. Cognitive-preference testing in the natural sciences - some question-marks. *Eur. J. Sci. Educ.*, *1*, 4 (October-December 1979), 417-425.

See below for Tamir's work on cognitive preference. Here, a colleague questions some of the procedures and assumptions in CPTs, and recommends the collection of more evidence of their validity.

Kenkel, L A. Teaching mitosis with playing cards. *The Sc. T.*, *47*, 6 (September 1980), 40-41.

This is a visual aid which should appeal to the pupils, but it requires investment of money and time in making the display boards, which would then have to be stored. The idea could be adapted for a flannel board or magnet board, which would also have other uses.

Kerry, T. Thinking in science lessons. *S.S.R.*, *63*, 223 (December 1981), 355-360.

The Teacher Education Project has developed a procedure for analysing verbal transactions in the classroom. This writer observes that most of the teacher transactions are concerned with management, with a large number also giving information. Very few stimulate higher level thinking. He suggests ways in which time spent on managing and informing can be reduced, and how more attention can be paid to stimulation. A M Kauffman, writing in *S.S.R.*, *63*, 224 (March 1982), 576, suggests that three important categories have been overlooked: pupils' questions, teachers' responses to these, and pupils' unsolicited comments.

Lipschitz, C; Daniels, D J. Power play (an electricity game). *S.S.R.*, *63*, 222 (September 1981), 143-145.

This is a card game for Form 3 upwards. It gives practice with P, V, I, R, Ω equations and should give a feel for the characteristics of various appliances. As usual, the preparation of the cards for a whole class will take a bit of time, and some details will have to be changed to suit our local mains voltage. A teacher would be wise to draw up his own masters, pasting the resulting copies to Bristol board before guillotining. This is one of the better games and should be worth the trouble.

MacInnes, I. A comparison of methods of solving problems on calorimetry and momentum. *S.S.R.*, *63*, 223 (December 1981), 300-302.

The writer first shows that a chemist's approach to a simple calorimetry calculation is fundamentally different from a physicist's. He then compares both approaches when applied to a similar momentum situation. Implications for learning are considered.

McVittie, R. Physical versus chemical properties. *Chem 13 News*, 123 (May 1981), 7.

Some fun with NI_3 if you can get it.

_____. Le Chatelier's Principle. *Chem 13 News*, 125 (October 1981), 11.

This demonstration of the shift in equilibrium due to a change in pressure is easily carried out with NO_2 and a large syringe.

Mandell, A; Cherry, T. 'Germ warfare'. *The Sc. T.*, *47*, 6 (September 1980), 37.

A board game to add to your collection.

Marshall, S. Communication studies and the extended power station game. *Phys. Educ.*, *16*, 6 (November 1981), 347-351.

Bibliography No. 1 (Millar, p. 10) mentioned the use of the game with primary student-teachers. Marshall describes how he used it in communication studies at a polytechnic, with engineering students. A chart shows how the communication theory was slotted into stages of the game.

Martino, J T. Tips for reading a chemistry text. *Chem 13 News*, 127 (December 1981), 2-3.

These tips should help science teachers teach reading and science at the same time. The illustrations are from chemistry, but the tips are more general.

Metz, R. Geological game of EEO. *The Sc. T., 48*, 5 (May 1981), 41.

This describes a game based on Monopoly which can be used to reinforce geology concepts. This sort of idea could easily be adapted to other teaching areas too. *(PAI)*

Millward, P. Equilibrium - a couple of useful ideas. *NZ Science Teacher*, 29 (June 1981), 47.

The first idea can be used to convey the concept of equilibrium in no particular context: water is transferred from one container to another. The second idea (with ammonia) could be associated with Le Chatelier and upper chemistry.

Morgan, H A. Learning from the environment. *Science Journal, 2* (1981), 35-36.

A primary teacher discusses the ways in which the environment as a resource can contribute to learning. Teachers looking for concrete suggestions will not find them here.

Morrison, I. An operational amplifier intercom. *S.S.R., 62*, 221 (June 1981), 737-738.

If you build electronic circuits, try this one. As well as demonstrating op amp with feedback, it is a useful device for home or lab. Alternatively, your electronics colleague may help, or it could be a project for pupils with soldering skills.

Moshman, D; Thompson, P A. Hypothesis testing in students: sequences, stages and instructional strategies. *JRST, 18*, 4 (July 1981), 341-352.

The writers propose 6 sequences in the development of hypothesis testing and contrast these with an alternative involving 3 global stages. Relative advantages and difficulties of the stage and sequencing conceptualizations are discussed. Three 'families' of teaching strategies are described and it is argued that one of these, self-regulated cognitive activity of the student, plays a crucial role in the construction of hypothesis testing strategies. *(PAI)*

Needham, G. How many significant figures? *S.S.R., 63*, 222 (September 1981), 185-187.

This is a letter responding to Webb's note mentioned in Bibliography No. 5 (p. 11). Needham feels that Webb's ideas are complicated and out of touch with real life. He suggests an alternative approach which should give the student a feel for significant figures by asking him to use his judgment.

Nussbaum, J; Novick, S. Brainstorming in the classroom to invent a model: a case study. *S.S.R., 62*, 221 (June 1981), 771-778.

Have you ever wondered if it is possible to give 12-13 year olds a concept of the particulate nature of gases? And have you doubted whether these children can arrive at the theory themselves? These authors describe a sequence of two lessons in which they succeeded, and, as well, generated much excitement in the children. The strategies are explicitly related to principles of learning. The article would give teachers much insight and practical help.

Orlich, D C; Migaki, J M. Watch your IQQ (Inquiry Questioning Quotient). *Sc. & Ch., 18*, 8 (May 1981), 20-21.

Questioning techniques play a vital role in science teaching and this article discusses the kinds of questions that teachers should ask (assuming that a regurgitated fact is not the required answer). *(PAI)*

Phillips, W D. Enzyme rummy. *S.S.R., 63*, 222 (September 1981), 106-110.

This is a game dealing with the action of digestive enzymes at O-level. For a whole class, many cards are required, but the work of preparation should be worthwhile.

Plewes, J A. Mixed ability teaching ... a deterioration in performance. *S.S.R., 63,* 222 (September 1981), 163-164.

This article describes a carefully controlled experiment in one school. Although the strategies have limitations, the findings give food for thought.

Postiglione, R A. Mnemonics: a biology teaching aid. *The American Biology Teacher, 43,* 1 (January 1981), 48, 64.

Various mnemonic devices are given to help students remember some aspects of biology. Teachers may prefer to use the idea to develop their own mnemonics. *(MC)*

_____. Ten ways to use your hands in teaching biology. *The American Biology Teacher, 43,* 7 (October 1981), 392-393.

Ten diagrams illustrate opportunities for using hands as a visual aid in biology teaching. *(MC)*

Read, D B. The Coriolis effect. *S.S.R., 63,* 223 (December 1981), 371-372.

The writer of this letter suggests how the Coriolis effect might be treated in school physics at various levels.

Rowbotham, N. Using a microcomputer in science teaching. *S.S.R., 63,* 222 (September 1981), 70-77.

A teacher describes how he uses his microcomputer in chemistry, and reflects on the pros and cons of home-made programs.

Sa..s, M K. Group work in science: myth and reality. *S.S.R., 62,* 221 (June 1981), 765-769.

After observing eighteen science lessons with mixed ability groups, the writer found a gap between what teachers and curriculum developers claim and what actually went on. Group strategies were not effectively used. This article will be helpful to teachers attempting to deve op this kind of skill.

Shadmi, Y. Archimedes' law as a problem in statics. *Phys. Educ., 16,* 5 (September 1981), 270-273.

Archimedes Principle often proves rather frustrating to teach. It can be presented didactically with a large-scale teacher demonstration; or it can be a cook-book class exercise from which the data are so unreliable that the teacher has to "cook the books" all over again. Shadmi now describes an inductive approach in which observations of floating and sinking lead to a general law. He still uses the eureka can, but in a new way. His central thesis is that children should already understand force and action/reaction, and be acquainted with the analysis of problems in statics. Then, he says, Archimedes can be grasped very quickly. I intend to ask my physics student-teachers to try it out.

Shinohara, F. Improvement of science and mathematics education with the use of computer-assisted instruction (CAI) system. *RECSAM Journal, 4,* 1 (January 1981), 42-49.

Although this article provides detail which is not of general interest, it does show that CAI can help the teacher provide a responsive environment for the child. The illustrations are from physics and mathematics from Grade 2 to Grade 13.

Simons, G. Diet analysis - a microcomputer program for O-level. *S.S.R., 62,* 221 (June 1981), 687-693.

When you have your microcomputer, your pupils can compare their dietary intake of energy, protein, vitamins and minerals with one another and with recommended figures. The program and worksheets are offered.

Smith, C G; Moore, C G; Thomas, R W. The thermal decomposition of sodium nitrate. *S.S.R., 63*, 222 (September 1981), 184.

Bibliography No. 6 (p. 18) mentioned a letter from Billington pointing out that this reaction is not as described in text-books and by examining boards. Here we have three more letters which show that the evolution of NO_2 should have been noticed long ago, but that this is "a case of seeing what you expect to see". Towse, in *S.S.R., 63*, 224 (March 1982), 575-576, gives further information.

Smith, D. Tiddlers and whales: some science with the fishing rod. *S.S.R., 63*, 223 (December 1981), 334-336.

Forces are put into the context of fishing. You can even land a large boy from a swimming pool! There are also some thoughts on applied physics. Suitable for lower secondary upwards.

Sutton, C. Cloze procedure and reading for meaning. *S.S.R., 63*, 222 (September 1981), 192.

The writer of this letter suggests how the deletion of whole sentences from a passage would encourage pupils to focus on the meaning of the whole passage, rather than look for merely local clues, as might be the case with the usual cloze approach.

Tamir, P. Cognitive preferences in agriculture of middle-school students and their teachers. *Eur. J. Sci. Educ., 1*, 3 (July-September 1979), 327-338.

Four modes of attending to scientific information have been identified; briefly, these are recall, principles, critical questioning and application (usefulness). Pupils and teachers responded to a cognitive preference inventory based on the Israel middle school agriculture curriculum. A variety of significant relationships were found, while other factors were not found to be significant. Information of this kind should be most useful to teachers and curriculum developers, but great caution should be used in extrapolating to other populations. The inventory used must be based on the curriculum the pupils have been following. Tamir found, *inter alia*, that cognitive preference was related to sex, grade level, father's occupation, new/old curriculum, and section of the curriculum. See also Jungwirth, above.

Tonkin, J; Daniels, D J. Electrominoes. *S.S.R., 63*, 223 (December 1981), 332-333.

This is a domino game intended to help children associate circuit symbols with their names. It should go down well with our West Indian children, but the electrominoes as pictured are rather tiny and would be better if enlarged on a photocopier before pasting to Bristol board and cutting.

Tornkvist, S. Mastermind and the scientific method. *Phys. Educ., 16*, 6 (November 1981), 344-346.

A university teacher attempts to restore curiosity after it has been repressed at school, and to develop problem-solving ability in first year students. His strategy is to have them play Mastermind, and to discuss their approach, in terms of scientific method, along with other more realistic scientific problems. A small experiment has indicated that the game does help in developing a systematic approach. The game is described and can be easily organised. Sixth form science teachers may wish to try it as well.

Tyson, L. How to plan and carry out a science project. *Science Journal, 2* (1981), 37-39.

General advice on the conduct of a scientific investigation and its presentation, e.g. for a Science Exhibition. The article might have been more practical if it had recognised the difficulties that can arise.

Ward, A. Helping to explain energy with a 'Boomerang Drum'. *S.S.R., 63*, 222 (September 1981), 154-155.

This is a 'black box' in which rubber bands wind themselves up and then unwind. Teaching notes are provided. It should generate 'wonder and delight'.

_____. Three primary science case histories. *S.S.R., 63,* 223 (December 1981), 237-246.

This article describes three series of lessons whose themes are, respectively, pulses as timers, string telephones and parachutes. As well as describing his strategies, he draws attention to his mistakes. There is extensive quotation from the children's reports. Primary teachers and teacher educators for this level should read the article. Weak proof-reading somewhere makes the sequence of teaching a bit difficult to follow.

_____. Modelling energy concepts with a 'mousetrap bomb'. *S.S.R., 63,* 223 (December 1981), 334.

A mousetrap stores "and concentrates" energy. A line of vertical dominoes acts as a fuse and detonator. An analogy is drawn with pirates and gunpowder. Suitable for early studies on energy.

Ward, C R; Greenbowe, T J. Cathodic protection: an overhead projector demonstration. *J. Chem. Ed., 58,* 6 (June 1981), 505.

A very quick demonstration showing how buried pipes, ships and storage tanks are protected by a sacrificial anode, which oxidises and releases electrons to the metal to be protected. The demonstration uses iron nails and zinc strip.

Wellington, J J. 'What's supposed to happen, sir?': some problems with discovery learning. *S.S.R., 63,* 222 (September 1981), 167-173.

The article begins by sketching the history of the case for discovery, and advantages of this approach to imparting science. It then turns to the objections, first the practical ones that teachers are quick to mention, then more fundamental ones from the philosophy of science and the psychology of learning. Some alternative approaches are considered.

Wham, A J B. The scientific debate - a lost art. *S.S.R., 62,* 221 (June 1981), 778-779.

A classroom debate on some aspect of science has a great deal of spin-off. Preparation is essential, and this teacher advises what should be done.

Young, B. The suffocating candle. *S.S.R., 63,* 222 (September 1981), 188-189.

The writer of this letter refers to correspondence mentioned in Bibliographies No. 5 (Whittaker, p. 17) and 6 (Gray, p. 6). Although he agrees that the explanation of the phenomenon is complex, he feels that the explanation is not the point. Once teachers can get away from the idea of providing factual explanations for everything, they should find it easier to take children through a series of experiences which will help them to develop skills of scientific thinking. (He illustrates in the context of the burning candle). He considers implications for primary teachers and teacher trainers.

CURRICULUM AND EXAMINATIONS

Black, P J. A new landscape. *Phys. Bull., 32,* 12 (December 1981), 381.

A common examination system at 16+ is likely in Britain in 1987. The director of the Chelsea Centre for Science Education is alarmed by the British national criteria for physics, which he feels have been worked out too hastily. This article should be read by those whose curricula are still influenced by GCE. These could very well include those who are developing the Caribbean Examinations Council syllabuses.

Bleyberg, W. Objective test? *S.S.R., 62,* 221 (June 1981), 791.

A teacher gave an O-level chemistry multiple choice test twice to a class, 9 days apart. Both sets of scores are provided, together with the number of changes made by each boy. The total scores could be used for a test-retest determination of reliability (not carried out, but inspection suggests that reliability would be high). However, the number of changes in selection gives food for thought, and the teacher asks "What price consistency?" What criteria was the test actually measuring?

Brown, C A. A sandwich course for primary science. *S.S.R., 63,* 223 (December 1981), 342-343.

This article describes a strategy in one area of England. It arose from the expressed needs of teachers for help in clarifying what is expected of them and in disseminating appropriate science teaching in their own schools. The support of administrators is required, not least for the release of teachers for the college parts of the course. There has so far been no evaluation.

Brown, M. Search for self-respect. *Phys. Educ., 16,* 6 (November 1981), 321-322.

The article examines social and historical reasons for the "entirely unsuitable pattern" of science in schools.

Buttle, J W. The implications of the 'Science in Society' project. *S.S.R., 63,* 222 (September 1981), 187-188.

The writer of this letter is critical of what he identifies as a failure to recognise differences in human values in a study of society. He also feels that other subject teachers should have been involved. In short, he appears to believe that the values throughout the course are those of the scientific "establishment".

Catalá-Poch, A. Course of astronomy for teachers. *Astronomy Newsletter,* 9 (June 1981), 11-12.

The article lists 44 topics in an introductory course for primary teachers at the University of Barcelona. A useful list for anyone designing a space-science course or unit, e.g. for CXC integrated science.

Chapman, B R. The school curriculum - a response to a response. *Phys. Bull., 32,* 11 (November 1981), 348.

The writer's view is that recent British proposals for restructuring the curriculum are a rear view which take no account of developments in society (just as teaching methods tend to predate the invention of the printing press). He suggests a 13-16 structure in which there are more courses studied for shorter periods, e.g. one-term courses on science and sport, science and music, physics/technology. Then there would be no need to make science compulsory for everyone. In *Phys. Bull., 33,* 1 (January 1982), 7, R G Cawthorne comments critically. He is attracted by much in Chapman's proposals, but points out that they will have to be more carefully marshalled. And in *Phys. Bull., 33,* 2 (February 1982), 44, C A Crofts argues that employers and all levels of higher education would not be satisfied by such a course.

Fensham, P J. Co-operation between cousins: science and mathematics educators look at what is possible and what has proved not possible. *Eur. J. Sci. Educ., 1,* 3 (July-September 1979), 347-352.

This is a somewhat critical review of the outcomes of an ICSU/Unesco meeting in 1978. Fensham seems to feel that participants took a rather simplistic view of the issues, problems and challenges, and the article could lead to debate between science and maths teacher educators. The title of the article is not particularly informative.

_____. Science and society in the Australian senior secondary school. *ICSU-CTS Newsletter*, 8 (December 1981), 23-25.

A brief account of the emphasis in the Australian physical science curriculum, "Man and the Physical World". Uptake and modification in some Australian states is mentioned.

Ferguson, D; Perris, L. Some science curriculum notes. *NZ Science Teacher*, 29 (June 1981), 34-37.

An account of developments in agriculture education and moderation of school based assessment in modular science.

Gestrelius, K. Lifelong education - a new challenge. *Eur. J. Sci. Educ.*, *1*, 3 (July-September 1979), 277-292.

The concepts of lifelong education, recurrent education and lifelong learning are first explored. Necessary conditions for lifelong learning are outlined. A Unesco study developed a set of criteria for determining factors favourable to lifelong learning, the criteria being listed here. The author describes how these were applied in Sweden, and gives the results of the analysis. Deficiencies are identified. Science educators elsewhere could find this article of interest in judging whether what goes on in schools and in science teaching is conducive to lifelong development.

Harding, J. Science in men's society. *S.S.R.*, *63*, 223 (December 1981), 368-371.

The Science in Society materials are criticised as displaying a massively insensitive and arrogant male interpretation.

Heine, V. Core syllabus. *Phys. Educ.*, *16*, 6 (November 1981), 323.

A professor of physics at the Cavendish Laboratory is "speechless" that the A-level core syllabus for physics never mentions the applications of physics. Other comment was mentioned in Bibliography No. 6 (p. 16).

Hofstein, A; Nae, N. Chemical case studies: science-society "bonding". *The Sc. T.*, *48*, 5 (May 1981), 52-53.

A brief article on a case study on the production and use of bromine which made chemistry relevant to a group of Israeli students. Similar case studies would not be difficult to develop in the Caribbean. *(PAI)*

Hondebrink, J G. Towards new chemistry curricula in secondary education in the Netherlands. *IUPAC Newsletter*, 16 (December 1981), 7-8.

A brief description of the weaknesses which have led to a revision (outlined). This should be of interest to teachers thinking about sequencing in the secondary years.

Hudson, H T; Rottmann, R M. Correlation between performance in physics and prior mathematics knowledge. *JRST*, *18*, 4 (July 1981), 291-294.

A study based on the performance of 1403 students in an introductory professional physics course indicates that prior mathematical ability is a prime influence on performance in the course and seriously influences the tendency to drop out of the course. More evidence on the need for a physics student to have a good mathematical background. *(PAI)*

Ingle, R B; Turner, A D. Science and mathematics in school: towards an inter-disciplinary approach. *EiS*, 93 (June 1981), 31-33.

Teachers are well aware that pupils have difficulty transferring their learning in maths to their science studies. Yet few schools have done anything about integrating policy and teaching for science and maths. Some resources are mentioned, and the article ends with a plea for integration at the teacher education level.

Jegede, O J. An evaluation of the Nigerian Integrated Science Project. *ICSU-CTS Newsletter*, 8 (December 1981), 26-27.

A synopsis of a PhD study. It could be of interest to those concerned about the success of integrated science in general and the STAN materials in particular.

Klaus, M. An integrated approach to energy education. *Sc. & Ch., 18*, 8 (May 1981), 8-9.

A description of a third grade energy programme which involves maths, social studies, economics, household management. It could easily contain lots more! *(PAI)*

Nishinosono, H. The assessment of pupils' performance in science education in Japan. *J. Sci. Educ. Japan, 4*, 4 (1980), 149-161.

The article outlines a variety of techniques for obtaining information about pupils' thinking. Some can be computer-processed, even in the classroom, some are open-ended, all appear to be innovative. This article is for researchers.

Ōki, M. Social goals and science education in Japan. *J. Sci. Educ. Japan, 4*, 4 (1980), 121-127.

The author suggests approaches which could help the achievement of social goals. Deploring the common view that science is remote from the general public, he illustrates how science is based on human thinking, and relates fundamental concepts and daily life experiences. He then turns to memorisation/inquiry and induction/deduction. The article closes by observing that science majors as well as non-science majors need to consider the social implications of science. The article is not particularly easy to follow.

Ormerod, M B. The social implications of science and science choices at 14+. *S.S.R., 63*, 222 (September 1981), 164-167.

Earlier work was mentioned in Bibliography No. 6 (pp. 13, 24). Here he describes a closer investigation into attitudes to the social implications of science, subject preference and liking for the teachers. After reporting his findings, he concludes that work on the social implications of science should be undertaken before 14+

Perrin, M; Thompson, D. The earth sciences and the core curriculum - a case for consideration. *EiS*, 95 (November 1981), 29-31.

There has been increasing awareness that the earth sciences should be included in general education to 16+. Quoting extensively from a Royal Society publication, this article answers the questions "What is earth science?" and "What use is it?"

Pipes, M J. A single system of examining at 16+. *Phys. Educ., 16*, 5 (September 1981), 296-299.

This article will be of interest to anyone associated with British exams, including overseas O-level. It describes what is happening in Britain. The government has decided that, where there was one system for the top 20% (O-level) and a different system for the next 40% (CSE), there will now be one system. And, where each examining board was largely autonomous, they must now all agree. The changes are likely to appear quite soon and to influence our A-levels as well as, of course, our O-levels until we switch completely to CXC. This article describes, more clearly than others I have seen, just what is going on in Britain.

Plimmer, D. Science in the primary schools: what went wrong? *S.S.R., 62*, 221 (June 1981), 641-647.

This is an exploration of why primary teachers are so reluctant to teach science. Possible factors identified are ability, style of learning, attitudes to science, and difficulty in understanding scientific literature. Primary science is seen as just one link in a vicious circle of events.

[Project notes]. *S.S.R., 62,* 221 (June 1981), 758-761.

Like CXC, certain UK exams require pupils to carry out a project. Here are some abstracts of biology projects, A-level and CEE. Ideas for science fairs, anyway, if you do not wish to build them into your curriculum.

Roy, A E. Astronomy in the education system. *ICSU-CTS Newsletter,* 8 (December 1981), 20-23.

At a conference in 1981 there was general agreement that astronomy should be included in the primary and secondary school curriculum. The rationale is of interest in the context of the aims of education. Difficulties were recognised and a network of resource centres proposed.

Sanderson, D J. Examinations in the Third World. *S.S.R., 63,* 222 (September 1981), 179-180.

A teacher in the Turks and Caicos Islands describes how GCE has an unhealthy effect on teaching. He appears to be unaware of the Caribbean Examinations Council and its science syllabuses and examinations. CXC was set up to solve the very problems he describes.

Sherratt, W J. History and philosophy in school science. *S.S.R., 63,* 223 (December 1981), 371.

This letter observes that the history and philosophy of science as a means of humanizing and liberalizing school science courses has been urged since the beginning of this century. He suggests that more positive action is now needed.

Stahl, P A. Astronomy as a vehicle for motivation in science education. *Astronomy Newsletter,* 9 (June 1981), 7-10.

A teacher in Barbados describes how children responded much more enthusiastically than their teachers to approaches from the Barbados Astronomical Society and eventually formed a Student Astronomy Club. He also uses "the Father of the Sciences" to motivate and integrate in his his teaching for CXC integrated science. He observes that science educators tend to anticipate children's interests within our own frame of reference.

Stronck, D R. The Surgeon General's request for nutrition education. *The American Biology Teacher, 43,* 5 (May 1981), 278-279, 283.

Nutrition is an advancing science, not recognised as such in textbooks and school courses. This article draws attention to some of the Surgeon General's (practical) recommendations, as well as to other studies and recommendations. It should be read by nutrition and other life science teachers, whose responsibility would then be to disseminate its contents to their colleagues. The discussion includes attention span and learning capacity, the health of the nation, and in-service training for teachers. *(MC)*

Subahan, T. An alternative approach to teaching the concept of field in secondary level physics. *RECSAM Journal, 4,* 1 (January 1981), 27-33.

Although this article is supported by a wide-ranging list of references, it gives no evidence of practical experience; and most chalk-face teachers would dismiss it as yet another attempt to influence classroom practice by ivory-tower educational theory. However, any attempt to introduce principles and concepts is rare, and deserves attention. A-level and undergraduate teachers willing to digest learning theories in this physics context could find the article stimulating.

Swindells, Y. Nutritional goals for New Zealanders. *Journal of the Association of Home Science Alumnae, XLVV* (sic), (1981), 11-15.

Effective nutrition education starts with the foods people are actually consuming, and thus must be culture-based. New Zealanders are known to take in too much food. Accordingly, this list of 12 goals, and the discussion, will not necessarily be appropriate for other societies. However, the article could prove very useful for life science teachers wishing to inculcate sound practice in the world of today and tomorrow.

Tebbutt, M J. Teachers' reactions to the JMB A-level physics options. *Phys. Educ., 16,* 6 (November 1981), 369-375.

Althouth the context is limited (Britain, physics, one particular GCE syllabus), the article could be useful in predicting how teachers might react to an innovative syllabus. The writer identifies some weaknesses in his procedures, and the article could be useful to those about to embark on similar surveys, whether or not they know anything about physics.

Uzzell, P S. The curriculum: whence, why and whither. *S.S.R., 63,* 223 (December 1981), 343-348.

This historical account of the degree of attention to science in schools from the mid nineteenth century raises questions about whether future decisions will be based purely on the educationally desirable.

Vallender, G D. Earth science in New Zealand secondary schools. *NZ Science Teacher,* 29 (June 1981), 5-11.

The writer's view is that earth science does not receive the attention in schools that this expanding science deserves. The article includes a suggested scheme. The emphasis is on upper school.

Ventura, A K. Science in a changing society. *Science Journal, 2* (1981), 25-30.

The Executive Director of Jamaica's Scientific Research Council describes science as he sees it, and its relationship to society in poor tropical countries like Jamaica. He identifies the emphases needed (e.g. biotechnology). Original and creative specialists are needed, as well as a logical and broadminded population. School courses in science need to include its history, its philosophy, its evolution, its contemporary failings and its future, and must be taught as a method of inquiry. This is an insightful article which faces the broad issues of concern to Third World science educators.

Waring, M. The implementation of curriculum change in school science in England and Wales. *Eur. J. Sci. Educ., 1,* 3 (July-September 1979), 257-275.

The limited evidence available suggests that, in the dissemination and diffusion of curricula, the project teams were not too successful in developing teachers' perceptions of the projects' messages. Accordingly, and also because more attention was paid to the materials than the teachers, implementation has been less than expected. She concludes that innovation needs to arise from teachers working together (with some outside help) on classroom-based action research, reflecting on their own practice and building a body of theory rooted in the real world of the classroom.

_____; Schofield, B; West, R W. A common core in science? - two points of view. *S.S.R., 63,* 223 (December 1981), 215-236.

The context is British, and has a background of government decisions and the particular kinds of schools that exist there. However, these three authors explore many fundamental issues in education that concern us everywhere, and the article is likely to be cited in the literature for quite a while to come. Both parts of the article stress that the idea of a common core and equality in education have profound implications and will not be easily achieved. Waring and Schofield explore a number of models (apples, mushy bananas and pips in a pomegranate) and conclude that core science might be possible in some form. West, from a much more subjective position, regards the notion as dangerous and pernicious nonsense. Since the core is likely to be derived from existing syllabuses, it will simply contribute to hardening of the arteries; a far more radical reconstruction of the school curriculum is required if human and social needs are to be met.

Woolnough, B E. Trends in school physics teaching. *Phys. Bull., 32,* 11 (November 1981), 363-364.

Many teachers take curriculum decisions as if all their pupils will eventually take a degree in their subject. For physics in England and Wales, this writer has found that the pyramid is such that 400 first and second formers → 150 fourth and fifth formers → 25 sixth formers → 1 student reading physics at university. Evidently the aims for the 400, 150 and 25 must go beyond the aims for the single future physicist/engineer. Pointing out that there are not enough physics teachers to cater for the needs of the 400, this article considers trends in staffing, physics in integrated science, and curricula emphasising physics for the enquiring mind, physics for action and physics for citizens. Although the context is physics and the UK, the messages are general ones.

YOUNG PEOPLE'S DEVELOPMENT

Adey, P. The cognitive demands of WISC: can the match be improved? *CJE, 8,* 1 (January 1981), 1-25.

The writer led the development of WISC and is a co-author of *Towards a Science of Science Teaching.* Here he outlines how the method of analysing cognitive demands was validated, and summarises the demand levels. A mismatch between WISC and West Indian children was found. Possible required strategies are discussed.

Boulanger, F D; Kremer, B K. Age and developmental levels as antecedents of science learning. *JRST, 18,* 4 (July 1981), 371-384.

27 studies are reviewed in this synthesis of studies related to age/grade, developmental level and science learning. They cover the 1963-78 period and deal with Grades 6-12. Annual increments in both developmental levels and cognitive achievement were noted. Student ability was found to be a better predictor of cognitive achievement than developmental measures. Age and grade were only weakly related to developmental level and cognitive achievement. *(PAI)*

Collis, K F. Measurement of conceptual growth - some new approaches to classroom testing. *RECSAM Journal, 4,* 1 (January 1981), 34-41.

The writer believes in the necessity for the kind of test which can be drawn up by the teacher in order to monitor the growth of concepts in relation to the curriculum he is teaching. Longitudinal records can be kept of individuals and of the class as a whole. Collis describes the development of paper and pencil tests, flash cards and card-sorting tasks. Although the examples are from mathematics, he says the techniques can be used in any subject. The approaches appear to be still in the gestation stage and the description perhaps inadequate.

Driver, R; Worsley, C. The Assessment of Performance in Science Project. *Eur. J. Sci. Educ., 1,* 4 (October-December 1979), 441-447.

The UK government has set up a unit (the APU) to develop methods for assessing and monitoring the achievement of children in school. This report briefly describes the aims of the Unit, and the strategies of the science group. The article is for educational researchers following the progress of the APU.

Karplus, R. Continuous Functions: Students' viewpoints. *Eur. J. Sci. Educ., 1,* 4 (October-December 1979), 397-415.

This article describes an investigation into children's ability to perceive and use non-linear relationships in science situations. Only the older subjects (Grades 10 and 12) tended to use a rectilinear approach, and very few used the necessary systematic procedure for the curvilinear situation, even after a demonstration of the interpolation procedure. Interviews revealed that many students were imitating procedures seen in their classes, without understanding them. Implications for the teaching of science and mathematics are discussed.

Linn, M C; Pulos, S; Gans, A. Correlates of formal reasoning: content and problem effects. *JRST, 18,* 5 (September 1981), 435-447.

This study examines the effect of the content of the task and the types of problems employed on the results of Grade 7 students on tests of formal reasoning. Both were found to have very significant effects and there was a highly significant interaction between them. Combinations of ability and personality factors were found to be uniquely related to each of the three types of task as well as to both analysis and controlling questioning types. *(PAI)*

Osborne, R. Children's ideas about electric current. *NZ Science Teacher,* 29 (June 1981), 12-19.

A summary of interviews with 43 children from Std. 4 (Grade 4) to Form 7 (Grade 13). The majority (even those studying physics at Form 6 and 7) had an inadequate view of current in the simplest circuits. The writer suggests that textbooks and we teachers are careless in making statements about electricity and current.

Peterson, A. Concept learning project in science and mathematics of Southeast Asian children. *RECSAM Journal, 4,* 1 (January 1981), 11-20.

The 8-year pilot project, completed in 1980, is summarised. The article will interest research workers in the same field.

Screen, P. ESTEAM. A curriculum development for exceptionally able children in science. *S.S.R., 63,* 223 (December 1981), 350-355.

A summary report of summer schools for 12-13 year olds thought to be in the top 2% of their age group. It is preceded by a discussion of the characteristics of the gifted child in science, and strategies for meeting his needs.

Shayer, M; Wylam, H. The development of the concept of heat and temperature in 10-13 year olds. *JRST, 18,* 5 (September 1981), 419-434.

Test items on 9 aspects of heat were given to 200 children in Leeds using 2 group tests lasting 45 minutes each. It was possible to describe Early Concrete, Late Concrete and Early Formal levels of understanding; and the hypothesis of different developmental paths dependent on previous experience was not sustained. This article would be of particular use to curriculum developers as well as teachers of upper primary and lower secondary grades. It might help us to avoid doing too much too soon. *(PAI)*

Watts, D M; Zylbersztajn, A. A survey of some children's ideas about force. *Phys. Educ., 16,* 6 (November 1981), 360-365.

With 125 third formers and 5 teachers, the authors investigated whether (a) the children's conceptual frameworks were as predicted in the literature (b) the teachers could predict these. As they offer their questions, I shall use them with my students and their pupils.

Wiseman, F L. The teaching of college chemistry: role of student development level. *J. Chem. Ed., 58,* 6 (June 1981), 484-488.

A group Piagetian test was admistered to college chemistry students in four different courses. Correlations between the scores on this test and the students' course and exam grades were calculated. Correlations were high for lower level courses, more moderate for higher level courses. Although the researcher does not consider the validity of the chemistry grading procedures, he raises some issues of interest. The investigation is worth repeating in many other situations.

SCIENCE FACTS

Ahmad, I. Radioactive isotopes: the biological detectives. *A Modern Approach to Chemistry*, 20 (July 1981), 32-35.

The bulk of this article is devoted to well-known information on atomic structure and radio-isotopes. The "biological detectives" section is disappointingly limited.

Ahmed, S A. Nomenclature for large numbers. *Phys. Bull., 32,* 11 (November 1981), 343.

As if 10^9 and giga- were not enough, the writer discusses the need for agreed names for large numbers to assist the economic, political and scientific communities, as well as publishers, journalists, commentators, children and the general public. Billion is the first ambiguity, representing 10^9 in some countries and 10^{12} in others. There are comments and other suggestions in *Phys. Bull., 33,* 4 (April 1982), 111-112. The suggestion that children should find easiest is the up-down one, where 'up', for example, means the power or the number of noughts. Thus '59 up 6' means 59 000 000 or 59×10^6.

Bender, A E. Hooked on sugar. *S.S.R., 63,* 223 (December 1981), 247-251.

Although this article deals with a significant social problem, it should be handled very critically. Only one of the three tables is referenced, and the fact that there is no bibliography is reflected quite clearly in the superficial treatment throughout. Use it with caution.

Bleyberg, W. The relative affinity of iodine and sulphur for zinc. *S.S.R., 63,* 223 (December 1981), 300.

A brief note describing an observation when zinc sulphide and a solution of iodine in potassium iodide are warmed together. It shows that chemistry still has surprises.

Butler, P A. New transuranic element. *Phys. Bull., 32,* 9 (September 1981), 283.

$^{262}107$, a fifteenth transuranic element, *appears* to have been produced. A new experimental technique for identification is described. Although the details are rather advanced, anyone teaching about the elements should up-date the facts presented.

Chadha, G S P; Nield, R E. Current/voltage characteristics of a tungsten filament lamp - a theoretical approach. *S.S.R., 63,* 223 (December 1981), 323-325.

Fortunately the authors do not suggest that a hands-on approach should be replaced by a theoretical one. They offer the relationships so that the teacher can check the accuracy of pupils' measurements with any lamps. Their theory is substantiated by experimental results, which disagree with a well-known author of laboratory manuals.

Cohen, R; Ganiel, U; Singer, D. Measurement of the magnetic flux density of the earth with a bicycle. *S.S.R., 63,* 222 (September 1981), 184-185.

Cole's investigation mentioned in Bibliography No. 5 (p. 1) was repeated by the writers of this letter. They conclude that the currents observed are thermal, not magnetic, in origin.

Danger in sight. *Phys. Bull., 32,* 9 (September 1981), 282-283.

Since 1 in 12 men may have some colour deficiency, and many of these will be unaware of their deficiency, there could be a high proportion of mistakes by those who assemble resistors, capacitors and wires. The solutions suggested do *not* include employing a higher proportion of women! There are some facts on the causes, frequency and results of colour weakness. The causes include long exposure to certain chemicals.

Daryll Evans, J. Talking about the gene. *S.S.R., 63,* 223 (December 1981), 294-296.

Beginning with definitions, this article goes on to suggest how the concepts might be conveyed at different levels in school.

Davidson, F. Carbohydrates in human nutrition. *Journal of the Association of Home Science Alumnae New Zealand, XLVV* (sic), (1981), 9-11.

Drawing on a FAO/WHO report, the author summarises the state of knowledge about lactose and dietary fibre. The occurrence of lactose intolerance has implications for public health measures. Dietary fibre of different types affects the occurrence of constipation and diverticular disease, and may influence trace-mineral absorption.

[Does ammonia burn?] *Chem 13 News*, 127 (December 1981), 12-13.

A question and several answers which include two demonstrations.

Feinstein, H I. Some types of chemical change. *Chem 13 News*, 123 (May 1981), 5-6.

A list of 12 types of chemical change is further subdivided. This could provide a useful handout, and a quiz based on it suggests itself.

_____. Conjugate redox pairs. *Chem 13 News*, 124 (September 1981), 5.

The author relates redox and acid-base reactions by providing a method for comparing strengths of oxidising and reducing agents other than by use of electrochemical data. This may be of some help in reinforcing the Bronsted-Lowry Theory. *(SN)*

Firsching, F H. Anomalies in the Periodic Table. *J. Chem. Ed., 58*, 6 (June 1981), 478-479.

The anomalies are (a) atomic mass out of sequence (argon-potassium, cobalt-nickel, tellurium-iodine), mono-isotopic elements and missing elements. These are explained in terms of nuclear stability, the half-lives of the isotopes and the formation and age of the earth. Of interest to O-level upwards.

Fremlin, J H. Teaching energy. *EiS*, 95 (November 1981), 36.

This letter argues a case for nuclear reactors, pointing out that they are unlikely to be suitable for making bombs.

Goldspink, G. Muscle: a remarkable machine. *S.S.R., 63*, 222 (September 1981), 78-93.

An alternative title would be "Adaptation - a property of life". It is one of the most interesting factual articles I have come across. It has aspects of physics, biology, chemistry, agriculture, athletics, and many other things, all very clearly explained for the non-specialist. This is a good illustration of how research science is so often integrated science.

Gough, W; Richards, J P G. Apparent wavelength of a source to a moving observer. *Phys. Educ., 16*, 6 (November 1981), 366-368.

This is a theoretical analysis suitable for A-level or post-A-level. Contrary to the common textbook treatment, the writers show that the apparent wavelength depends on whether the measurements are made directly from wavelength or indirectly from frequency; and that the latter is the more fundamental quantity. The article ends with a poser which suggests that the Michelson-Morley experiment proves nothing, so relativity is unnecessary!

Heddle, D W O. A universal curve for cassette tape times. *Phys. Educ., 16*, 5 (September 1981), 311-312.

Investigations into the angular motion of cassette tapes were mentioned in Bibliographies 4 (Jordinson, p. 4) and 6 (Gottlieb, p. 2). This note gives a curve which can be used to relate counter readings to take-up times on the spool.

Herbert, J M. Concentrated parallel beams of light. *Phys. Educ., 16,* 6 (November 1981), 332-335.

This is a theoretical article which makes no claims to testing the ideas in practice. Some A-level or tertiary physics teachers may wish to develop the ideas as a thought exercise with their students. On the other hand, teacher-educators may use the article as an illustration of the risk of turning physics into a paper and pencil discussion.

Holden, N E. Atomic weight - love it or leave it. *IUPAC Newsletter,* 16 (December 1981), 13-15.

This article describes the history of the arguments concerning the terms atomic weight and relative atomic mass. There is a difference of opinion among international bodies. The International Commission on Atomic Weights and Isotopic Abundances favours "atomic weight". A condensed version of the same article appears in *Chem 13 News,* 131 (April 1982), 4-5.

Hoon, S R; Tanner, B K. The physics of music. *Phys. Educ., 16,* 5 (September 1981), 300-311.

This is the substance of a Christmas lecture to school children. Since the audiovisual aids to the lecture are lost, the average physics teacher will have to concentrate quite hard in following the text. It contains lots of interesting bits of information, and the authors point out that much of the teaching can be carried out with equipment already existing in schools. However, most of us (those who are not musicians) will be without the confidence to apply it in our classrooms.

ten Hoor, M J. On oxidation numbers. *S.S.R., 63,* 223 (December 1981), 374-375.

The writer of this letter disagrees with Paterson and Stone (below) and provides a different definition and other rules.

Horne, R W; Harris, J R. The electron microscope in biology. *S.S.R., 63,* 222 (September 1981), 53-69.

Bibliography No. 5 (p. 6) mentioned a controversial article by Hillman and Sartory which criticised electron microscopists and others for lack of concern for truth in describing cell structure. The authors of the present article now leap to the defence of electron microscopists, and cite an extensive list of published evidence. A-level and tertiary life science teachers are advised to read both articles together.

Jones, D J. The manufacture of phenol *via* the cumene route. *SICCI Bulletin* 22 (May 1981), 18-32.

In the space of only 20 years, the cumene route has become the only route to phenol of any consequence. An appendix gives the history of phenol manufacture, beginning with its isolation from coal tar in 1834. The body of the article describes the process. (SICCI provides an abbreviated version for class use.) The article could be of interest to A-level chemistry teachers dealing with chemistry in technology and society.

Labianca, D A. Methanol poisoning biochemical considerations. *A Modern Approach to Chemistry,* 20 (July 1981), 29-31, 35.

Human consumption of methanol is a social problem relatively uncommon in this region, where rum is so readily available. The article, though set in an American context, however provides some interesting information on the physiological and biochemical effects of this type of alcohol. Although no detailed knowledge is needed to grasp the article, science teachers and 6th form biochemistry students could find it of interest.

Lambie, J H. On the wings of the *Gossamer Condor:* Adventure in human-powered flight. *The Sc. T., 48,* 5 (May 1981), 28-35.

Personal reminiscences as well as factual information by one of the team on the human-powered flight project. *(PAI)*

Letcher, T M; Ranftelshofer, G F. The gravitational effect on a burning candle in free fall. *S.S.R.*, *63*, 223 (December 1981), 309-311.

What part does gravity play in the supply of oxygen to a flame? This demonstration is too complex for most people to set up, but the account is worth reading.

Lewis, J I. The presentation of modern inorganic chemistry. *S.S.R.* Part V: polarising power and the chemical nature of oxides (hydroxides). *62*, 221 (June 1981), 722-724. Part VI: the relationship between polarizing power and other physical quantities. *63*, 223 (December 1981), 297-300.

Previous articles in the series were mentioned in Bibliographies 5, p. 16 (Parts II and III) and 6, p. 18 (Part IV by Anthony and Lewis). The series is for those who want to keep their chemistry up to date.

Manchew, P; McIntosh, C. An approach to incorporating nutrient requirements into the Caribbean food and nutrition plan. *Cajanus*, *14*, 2 (April-June 1981), 84-92.

Suggestions of appropriate energy and protein levels which could be achieved by the nutrition strategy. Particularly useful to general/integrated science teachers, biologists and home economists. *(PAI)*

Myers, A. The blue bottle reaction and photosynthesis. *S.S.R.*, *63*, 222 (September 1981), 112-117.

A parallel is drawn between the two processes. Some interesting investigations into the effect of light on the blue bottle mixture are described. This could be suitable for an A-level chemistry class which also does biology or botany.

Obudo, S. Crude oil refining. *A Modern Introduction to Chemistry*, 20 (July 1981), 23-28.

Although this account describes the process from first principles, the readability is more suited to upper secondary level. It is also recommended as background reading for *teachers* of our lower secondary Oil Project, although they would need to find out from other sources how to relate the facts to our local context.

[Oxidation numbers.]. *Chem 13 News*, 124 (September 1981), 10-11; 125 (October 1981), 10-11; 127 (December 1981), 13.

An inquiry about the reaction $FeS_2 + O_2 \rightarrow FeO + SO_2$ brought many different answers and an editorial note. Chemistry teachers and their 6th formers could find the differences of opinion intriguing.

Parton, C. Definition of the ampere. *Phys. Educ.*, *16*, 6 (November 1981), 323-324.

The writer of this letter is puzzled about why the unit of current is so defined.

Paterson, K. The oxidation number concept in organic chemistry. *S.S.R.*, *62*, 221 (June 1981), 714-715.

The author proposes a modification of the conventional method, to take account of changes in bonding. See also ten Hoor (above) and Stone (below).

Perumpoykail, S T. Air pressure: a new look at an old experiment. *RECSAM Journal*, *4*, 1 (January 1981), 21-26.

The old "experiment" is in fact the familiar demonstration often shown as an inverted glass of water. In this article, a number of hypotheses are tested, with the finding that the explanation of the phenomenon may be quite complex. The writer makes the point that science textbooks tend to give "half-truths" or wrong information when the authors take material from other books without trying them out. The candle in jar is given as another example. Physics teachers and textbook writers should read this.

Rushton, B S. An expanded classification of the plant kingdom. *S.S.R., 62,* 221 (June 1981), 648-654.

Acknowledging that biological classifications are 'poorly organised in elementary A-level texts' the article attempts to present a classification that emphasises both the unity and diversity of living organisms, the use of which 'should help to alleviate some of the problems encountered as a result of lack of guidance shown in GCE syllabuses.' The plant kingdom is expanded and is treated as a *Regnum* of the *Dominium* Eukaryota. The regnum is subdivided into three *sub-regna*, these are divided into *super-divisions*, *divisions* and in cases *subdivisions*. The subdivisions are separated into *classes*, the lowest taxon used in the expanded hierarchical classification. Justification for the expansion is given. A splendid case of taxonomic inflation! *(JD)*

Ssebuwufu, P J M. Hydrogen as an alternative to hydrocarbon fuels. *A Modern Approach to Chemistry,* 20 (July 1981), 4-12.

In the search for fuels which are cheaper and less polluting than fossil fuels, hydrogen is a strong candidate and is almost inexhaustable. The main problem at present is storage, but this article describes how hydrides of the transition metals can provide a cheap and convenient answer. This makes the article of interest to A level chemists. Various ways of using hydrogen as a fuel are outlined.

Stone, P J. Redox reactions of some organic compounds. *S.S.R., 62,* 221 (June 1981), 719-722.

An approach to deriving stoichiom tric equations for reactions between an organic substrate and an inorganic reagent. See also ten Hoor and Paterson (above).

Underwood, G. Introduction to the study of Jamaican reptiles, Part 2. *SEC Newsletter, 12,* 2 (November 1981), 18-21.

Part 1 was mentioned in Bibliography No. 6 (p. 20). Here the writer describes his observations on the appearance, behaviour and distribution of six anoles. Outside Jamaica, the article would be of limited interest, except to scientists specialising in reptiles or as an example of natural history observation.

Wells, R V. Celsius. *S.S.R., 63,* 223 (December 1981), 373.

Celsius did not invent the Centigrade scale - this was devised earlier by Linnaeus, and anyway the scale of Celsius was different.

Windbigler, J. The radiation hazard of coal-fired power plants. *J. Chem. Ed., 58,* 6 (June 1981), 500-501.

It has been predicted that, as petroleum reserves are depleted, much more use will be made of coal. This article shows how large coal-fired plants are likely to increase the radioactivity of the air we breathe, and to pollute a much larger area than a nuclear power plant.

Winick, M. Malnutrition and a young child's mind. *Cajanus, 14,* 2 (April-June 1981), 79-83.

A brief and very interesting review of research culminating in the discovery that malnutrition is generally reversible if the child grows up in an enriched environment. *(PAI)*

Woodley, C J; Champion, J A. Surface tension. *Phys. Educ., 16,* 6 (November 1981), 324-326.

This exchange arises from Champion's article mentioned in Bibliography No. 6, p. 19. It is only for inquisitive physics teachers at A-level and above.

MANAGEMENT

Code of practice on animals in schools. *The Sci. T.*, *47*, 6 (September 1980), 57-58.

This is a position statement of the NSTA. In essence, the message is "do to animals only those things you would want done to *you*!". Life science teachers would probably want to pin it up permanently in the lab. See also the NABT statement below.

Deeson, E. The Sinclair ZX81 - toy or treasure? *Phys. Educ.*, *16*, 5 (September 1981), 294-295.

The Sinclair microcomputer is extremely cheap. Deeson considers it incredible value for money. He draws attention to what it can do, and to its drawbacks (fewer than in an earlier Sinclair model). In a letter to *S.S.R.*, *63*, 223 (December 1981), 373-374, Deeson gives more details of costs of a package.

Dewhurst, P. Chlorine in schools. *S.S.R.*, *63*, 222 (September 1981), 176-179.

A survey has shown that the majority of schools used chlorine in the open laboratory. Even where it is prepared in a fume cupboard, its odour can often be detected in the laboratory. Safeguards are considered. The author also gives case studies of voluntary inhalation; and discusses the hazard of mixing certain types of domestic cleaner, and chlorine exposure in swimming pools.

Dumpert, K. An inquiry into the use of living organisms in biological education in West German schools. *Eur. J. Sci. Educ.*, *1*, 3 (July-September 1979), 339-346.

This article is included in the Bibliography because of its general implications for biology teachers. Teachers reading it are likely to reflect on their own views and practices, and to clarify the contribution of living organisms to learning.

Eye protection. *EiS*, 93 (June 1981), 27-30.

The most commonly reported type of school laboratory accident is that due to materials or radiation entering the eye. This article gives the ASE's advice on when eye protection should be worn by students, technicians and teachers, and the advantages and disadvantages of each type. There is a note about contact lenses.

Griffiths, P; Stephens, J. Storing leads. *S.S.R.*, *63*, 223 (December 1981), 337.

The electrical leads are stored in sets in plastic book-binding spines. They are easily checked and do not tangle.

Hawkins, M H J. Focal lengths of diverging lenses and mirrors. *S.S.R.*, *62*, 221 (June 1981), 736.

A quick method of identifying diverging lenses and mirrors which have lost their envelopes. All you need is a ruler.

[Hazards.] *EiS*, 93 (June 1981), 21-22.

Part of a regular series from the ASE Laboratory Safeguards Sub-committee, these pages contain notes on 1, 2-dibromoethane (a possible carcinogen); burning calcium in oxygen (water could produce an explosive mixture of hydrogen and oxygen); sulphuric acid as a drying agent (acid can be sprayed round if narrow tubes become blocked by a solid product); and hyper-reactivity to irritating gases.

Henly, R L. A limewater dispenser. *S.S.R.*, *63*, 222 (September 1981), 136.

The dispenser is essentially an aspirator. It allows the filling of many bench bottles without disturbing the sediment.

Hilton, J. Physics extracts - Part VI (1980). *S.S.R.*, *63*, 223 (December 1981), 327-332.

This is a counterpart of Shaw's list below for 6th formers. There are 9 journals and 11 categories of articles.

Krepel, W J; DuVall, C R. **Obtaining** free biology and science materials. *The American Biology Teacher, 42,* 8 (November 1980), 488, 504.

The names of publications which give information about free materials are given. However, these publications cost money. From these publications, teachers can write for free materials. Some items are sent in class sets, if requested. *(MC).* (Editorial Note: *Many, if not all, of the American sources will send their free materials overseas - we have tried it.)*

Lealand, A. Care and servicing of laboratory equipment. *NZ Science Teacher,* 29 (June 1981), 29-33.

A servicing firm gives practical advice on electrical components, microscopes and selling old equipment like balances. If you don't understand the article, don't try to repair your apparatus.

Lovett, D. Soap film analogue of Fermat's principle and Snell's law. *Phys. Educ., 16,* 6 (November 1981), 376-379.

It will be necessary to cut some perspex and to construct the simple apparatus. Once this is done, one can model (perhaps on an overhead projector) refraction through a glass block, a prism and lenses, as well as mirages, seismic waves and the gravitational bending of light. It seems worth the trouble if you have the tools, the perspex and a competent technician.

Mansfield, D. A cheaper version of Fehling's solution. *S.S.R., 63,* 222 (September 1981), 117.

To reduce transport costs (for water), many schools make up their own Fehling's. The sensitivity to glucose of two recipes was compared, with the result that the much cheaper recipe was found adequate.

NABT guidelines for the use of live animals at the pre-university level. *The American Biology Teacher, 42,* 7 (October 1980), 426-427.

This is a policy statement from the National Association of Biology Teachers. The use of live animals should be limited. should be carried out humanely, and, where possible, should be carried out with lower orders of life such as the invertebrates. The statement deserves circulation among teachers of life science and laboratory assistants. See also the NSTA statement (Code of practice) above. *(MC)*

Rice, D R; Strope, J L; Brown, C L. Test your legal liability IQ. *The Sc. T., 48,* 5 (May 1981), 42-45.

Briefly describes 10 US oourt cases which arose out of accidents at school. The results are presented later. The sort of article which could start some teachers wondering about their own legal position when they conduct practical science classes, and might even lead to science teachers or their associations trying to find out! *(PAI)*

Rosser, A C. Wind vane models. *S.S.R., 63,* 222 (September 1981), 153-154.

A wooden and a metal model are described. The metal model requires metal-working equipment and skills, but is much more robust than the wooden one and much cheaper than commercial models. A suitable project for a production workshop such as Guyana's, or for an integrated science teacher with a co-operative industrial arts colleague.

Shaw, G W. A reading list for A- and S-level biology. Part XIII. *S.S.R., 63,* 223 (December 1981), 285-292.

The latest in a regular series, this list draws attention to many articles published in 5 periodicals in 1980. They are classified under 14 headings. You will be considerably restricted if you do not have access to *New Scientist.*

Sheldon, A. Leaf impressions. *S.S.R., 63,* 222 (September 1981), 110.

A simple method of preparing transparent impressions for examination with a microscope.

Shulfer, E. Insect watching and rearing. *Sc. & Ch., 18,* 8 (May 1981), 18-19.

In spite of our vast numbers of insects, we do not utilize them much in our science classes. Here is an article on keeping and observing grasshoppers and crickets in a fish tank. Although the instructions for keeping them during the winter are unnecessary, teachers could easily follow up some of the other ideas. *(PAI)*

Stevens, G H. Reclamation of silver residues. *Chem 13 News,* 124 (September 1981), 5.

Given the cost of $AgNO_3$, it is worth reclaiming it from AgCl. Detailed instructions are provided. These can be passed to your lab assistant. See also Herrmann on p. 3 above.

Stoane, J S. Microcomputers in school chemistry. *S.S.R., 63,* 223 (December 1981), 305-308.

Thoughts on the contribution that can be made to the learning of chemistry, especially by pupils who have difficulty with calculations. The writer points out that the instrument now costs less than a modest top-pan balance and can be expected to become cheaper than pH meters and other common equipment.

Tawney, D. Accidents in school laboratories: a report of an investigation. *EiS,* 95 (November 1981), 32-33.

A survey of *reported* accidents in Britain permitted identification of the most common kinds of accidents. A high proportion occurred in lessons involving chemicals. Although the frequency of reported laboratory accidents was low (0.05% of pupils per year), some simple precautions and appropriate actions were overlooked. Chemicals in the eyes accounted for 22.8% of the accidents, making a strong case for the compulsory use of goggles.

Watts, R T. A constant-volume dispenser for liquids. *S.S.R., 63,* 223 (December 1981), 308-309.

The apparatus is easily put together and dispenses small volumes quickly and to an acceptable accuracy.

White, A D. An all-glass effusiometer. *S.S.R., 63,* 222 (September 1981), 134-136.

The apparatus can be used to illustrate Graham's Law or to determine the relative molar mass of a gas. Some glass working is required.

White, R. Pressure and the hydraulic jack. *S.S.R., 63,* 223 (December 1981), 322-323.

As a student teacher the author constructed a model from syringes and tubing. His design could be easily copied. He mentions a variety of contexts in physics in which it could be used, but readers will have to work out their own details.

Wilford, D; Singleton, O; Holdsworth, A. A simple liquid crystal thermometer. *S.S.R., 62,* 221 (June 1981), 716-717.

Fifth form pupils constructed a temperature sandwich which changed colour over the range 6°C to 88°C, interesting in itself but also usable in observing temperature changes during neutralisation reactions and when a current is passed through a wire. You would have to get the liquid crystal material from America. There is a brief explanation of LCs.

GENERAL AND SOCIAL CONCERNS, AND COUNSELLING

Ainley, D; Lazonby, J N. Observation as a means of evaluation of science courses for less able children - a case study. *S.S.R., 62,* 221 (June 1981), 631-640.

This is an account of an investigation in which a pupil observation schedule was developed and validated. It could be of interest to students and tutors in teacher education courses.

Bliss, J; Ogborn, J; Grize, F. The analysis of qualitative data. *Eur. J. Sci. Educ., 1,* 4 (October-December 1979), 427-440.

These authors describe early stages in the development of an approach to analysing data from interviews, free questionnaires, examination questions and other "soft" data.

Bunker, D L. Why should anyone study chemistry? *A Modern Approach to Chemistry,* 20 (July 1981), 44-46.

This article appears to be written for the prospective undergraduate. It focuses on the nature of chemistry and chemists, and does not attempt to list careers.

Chavez, A. Children on low diets 'learn not to eat'. *Cajanus, 14,* 2 (April-June 1981), 67-70.

Some excerpts from remarks made at a conference in Mexico which present a frightening picture and put forward ideas which teachers would do well to consider. *(PAI)*

Education through science: the policy statement of the Association for Science Education, 1981. *S.S.R., 63,* 222 (September 1981), 5-52.

This policy has been gestating for several years. Its components are (1) the place of science in the school curriculum (2) the development of the school science curriculum, including pedagogic implications of science for all, assessment and resources (3) implementation. The summary on pp. 45-47 is usefully cross-referenced to the rest of the statement. Although the statement refers only to the UK, it will be of value to planners and anyone reflecting on his own contribution to science education, perhaps in teacher education courses. The summary is also published in *EiS,* 93 (June 1981), 23-26.

Ellington, H I; Addinall, E. The nuclear debate - examination of the issues. *Phys. Educ., 16,* 5 (September 1981), 274-281.

The article begins with projections about Britain's energy consumption and fuels available, indicating that there is no alternative to the eventual dependence on fast reactors. For other countries, the data would not apply, although the ideas would. The article then goes on to present, without comment, the views of opponents and protagonists of nuclear energy generation. The article would be suitable for fifth form science and non-science students, and could form the basis of a debate. Fremlin and Kneale below provide more one-sided views. The authors of the present article have developed a teaching package for just this purpose (reviewed on p. 316 of the same issue of *Phys. Educ.*).

Fremlin, J H. The case for nuclear power. *Phys. Educ., 16,* 5 (September 1981), 282-284.

In the context of the article by Ellington and Addinall above, Professor Fremlin argues hotly for conservation of fossil fuels for his grandchildren; and asserts that alternatives to nuclear power are much more hazardous than nuclear generators themselves. Some attention is paid to wind and wave power. His feelings are accompanied by factual assertions.

Kneale, G. Possible health hazards of nuclear power. *Phys. Educ., 16,* 5 (September 1981), 284-286.

A researcher in the field of nuclear exposure suggests that the probability of cancer arising from such exposure is 10-20 times higher than official estimates. He describes how difficult it is to arrive at estimates anyway.

Landor, S R. Chemistry in Uganda: a bright future! *A Modern Approach to Chemistry*, 20 (July 1981), 13-22.

The first part of this article takes a historical and social view, and would be useful to teachers wishing to convey that chemistry is a most important field of study. The last part looks at the role of Makerere University in meeting the needs of the country. It is related to the concerns of universities in the Third World.

Norman, H; Hiha, A. Sex-role stereotyping in science textbooks. *NZ Science Teacher*, 29 (June 1981), 20-21.

There is growing concern about sex-role stereotyping in science, which has a negative effect on girls' attitudes. Textbooks may be one determinant of stereotyping. These women examined 80 books, and found a male bias, stronger in secondary than in primary schools. The writers of the article have not been careful enough to exclude the possibility that they may be biased themselves. Mary Garlick in a brief note at the end of the article, gives advice on ways to counter the sex imbalance in science textbooks.

[NZSTA Newsletter.]. *NZ Science Teacher*, 29 (June 1981), 23-28.

The NZ Association, a much younger one than our ASETT, seems to be having more impact on policy. Their activities are worth study as well.

Odyek, O. Industrial chemistry. *A Modern Approach to Chemistry*, 20 (July 1981), 36-43.

The first part of the article outlines the stages and considerations when a laboratory process is developed into an industrial process. The last part describes how quality control, including sampling, is carried out for different kinds of product (solids, liquids and gases). Easy reading, and appropriate at the stages when (a) the relationship of school chemistry and industry are being considered (b) thought is being given to careers.

Perutz, M. Why we need science. *New Scientist*, 19 November 1981, 530-536.

A Nobel Laureate, FRS and molecular biologist, Peretz explores the balance between the benefits and the risks of science. His analysis is structured around health, food, and energy, but he closes with a discussion of political and societal "laws" and war. His view is that, if civilised life is to survive into the next century, all the resources of science and technology are needed. An important article for scientists, science educators and 6th formers.

Puttick, K E. Filling the learning gap. *Phys. Bull., 32*, 11 (November 1981), 349.

A university professor believes that many problems in school/university physics teaching would be solved by dual appointments of university staff - most of the time doing research in the university, part of the time secondment to a school. His ideas appeal; but he might have gone a bit further by suggesting *exchange*, as some A-level teachers in this country ought to be happy to take on N2 teaching. In *Phys. Bull., 33*, 2 (February 1982), 44, C A Crofts welcomes the idea of closer association between school teachers and the university physics department, but feels that the don would not have the skills needed to teach in a school.

Rooke, D. Science - fundamental to the school curriculum and the nation's future. *S.S.R., 62*, 221 (June 1981), 625-630.

An eminent scientist and industrialist argues that science is vital in the education of every citizen. If the individual does not learn science in school, it is very difficult for him to learn it afterwards. The illustrations are biased towards a particular industry in Britain.

Shimazu, Y. Social and economic influences in curriculum change in Japan - case history of environmental education. *J. Sci. Educ. Japan, 4,* 4 (1980), 167-173.

The Japanese attitude to nature is distinctly different from that of the Western world. This part of the discussion alone should be of great interest to those concerned about the culture gap which often exists between Third World countries and approaches developed in metropolitan countries. The rest of the article describes the environmental pollution which has increased so much in Japan, and the environmental issues which have appeared in school social studies and science curricula. This article should interest curriculum developers, science teachers and 6th form general studies students.

Standing Conference of European Ministers of Education. Resolution adopted by the *ad hoc* conference on society and the study of science, mathematics and technology. *Eur. J. Sci. Educ., 1,* 3 (July-September 1979), 357-360.

Recognising that SMT studies are necessary for democratic societies, and that they are not entirely satisfactory at present, the *ad hoc* conference makes a set of recommendations to the Ministers. There are appendices on awareness of science and technology, teacher training, assessment and selection, guidance, sex-related attitudes, adult involvement and recurrent education. This article is for policy makers.

Swarbrick, A. Women in technology - a role for the Open University? *Phys. Educ., 16,* 5 (September 1981), 266-268.

Even the few women in technology tend not to return after their work is interrupted to raise a family. This author points out that distance learning with its flexibility is ideal for women at home, and refers to an Open University scheme to increase retention of women.

Walford, G. Tracking down sexism in physics textbooks. *Phys. Educ., 16,* 5 (September 1981), 261-265.

It has already been established that older textbooks have a male bias. This writer has examined some British books published in 1979 and 1980. He finds that fewer illustrations or questions involve people but, where they do, the male bias persists.

Warburton, S J; Jenkins, W L. Some factors affecting the science provision for children in the 10-14 age range. *S.S.R., 63,* 223 (December 1981), 348-350.

This summarises some information from an English survey. Readers in other countries may find it useful to compare their own constraints.

Willmott, J C. Women in science. *Phys. Bull., 32,* 10 (October 1981), 309.

This writer deplores the position of women in science, and believes that serious action is needed if physics is to survive. In a letter in *Phys. Bull., 33,* 1 (January 1982), 4, David Dew-Hughes describes what the engineers are doing, apparently successfully, to attract schoolgirls into their profession.

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